

Mercury Control by EPRI MerCAP™ Process

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Presentation Outline

| Project Background

- Project objectives

| Host Site 2

- Description
- Planned tests
- Project status
- Initial results
- Future plans

| Host Site 1

- Background
- Discussion of recent work and final results
- Conclusions



Project Background

- | **Financial Assistance Program DE-FC26-03NT41993**
- | **Two Test Sites**
 - **Georgia Power Plant Yates Unit 1**
 - **Great River Energy Stanton Station Unit 10**

Project Team



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(COR)**

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**Juliana Kyle
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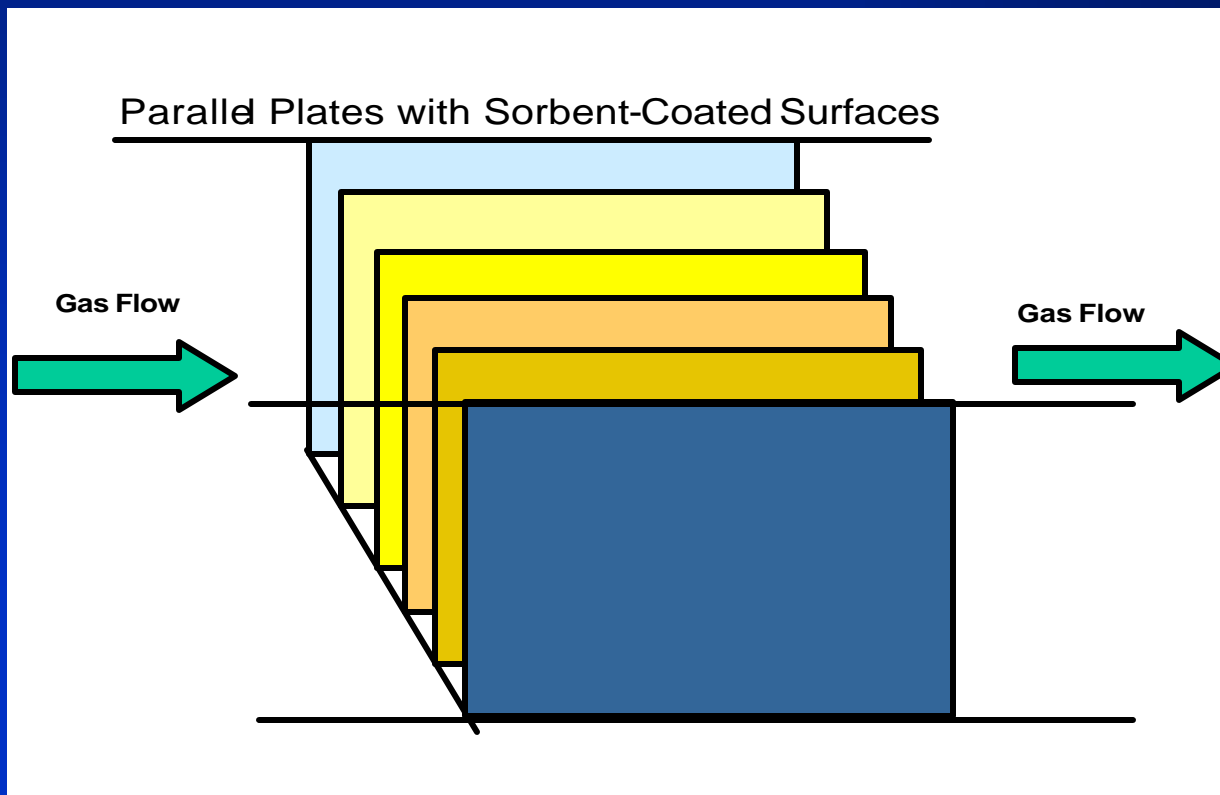
**Tim Ebner
Kevin Fisher
Rick Slye
Trevor Ley**



Sharon Sjostrom

Project Background

- Fixed sorbent structures to adsorb mercury
 - Gold substrates



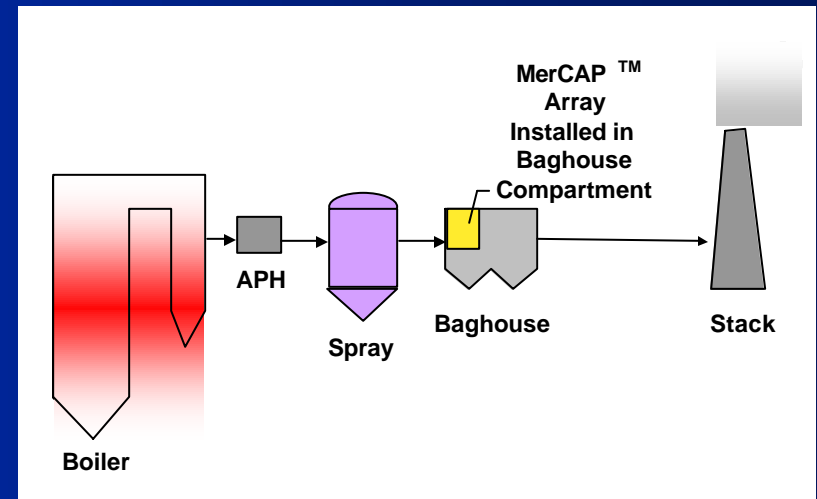
Project Background

- | Concept tested using small-scale probes since 1999
- | Full scale tests at two sites downstream of scrubbers
 - **Plant Yates Unit 1 (on-going)**
 - | 1 MWe slipstream fitted with gold plates
 - | Wet Scrubber (Chiyoda CT-121 jet bubbling reactor)
 - **Stanton Unit 10 (completed)**
 - | Full-scale baghouse compartment retrofitted with gold plates
 - | Dry Scrubber

Project Objectives

Evaluate MerCAP™ technology downstream of wet and dry scrubbers

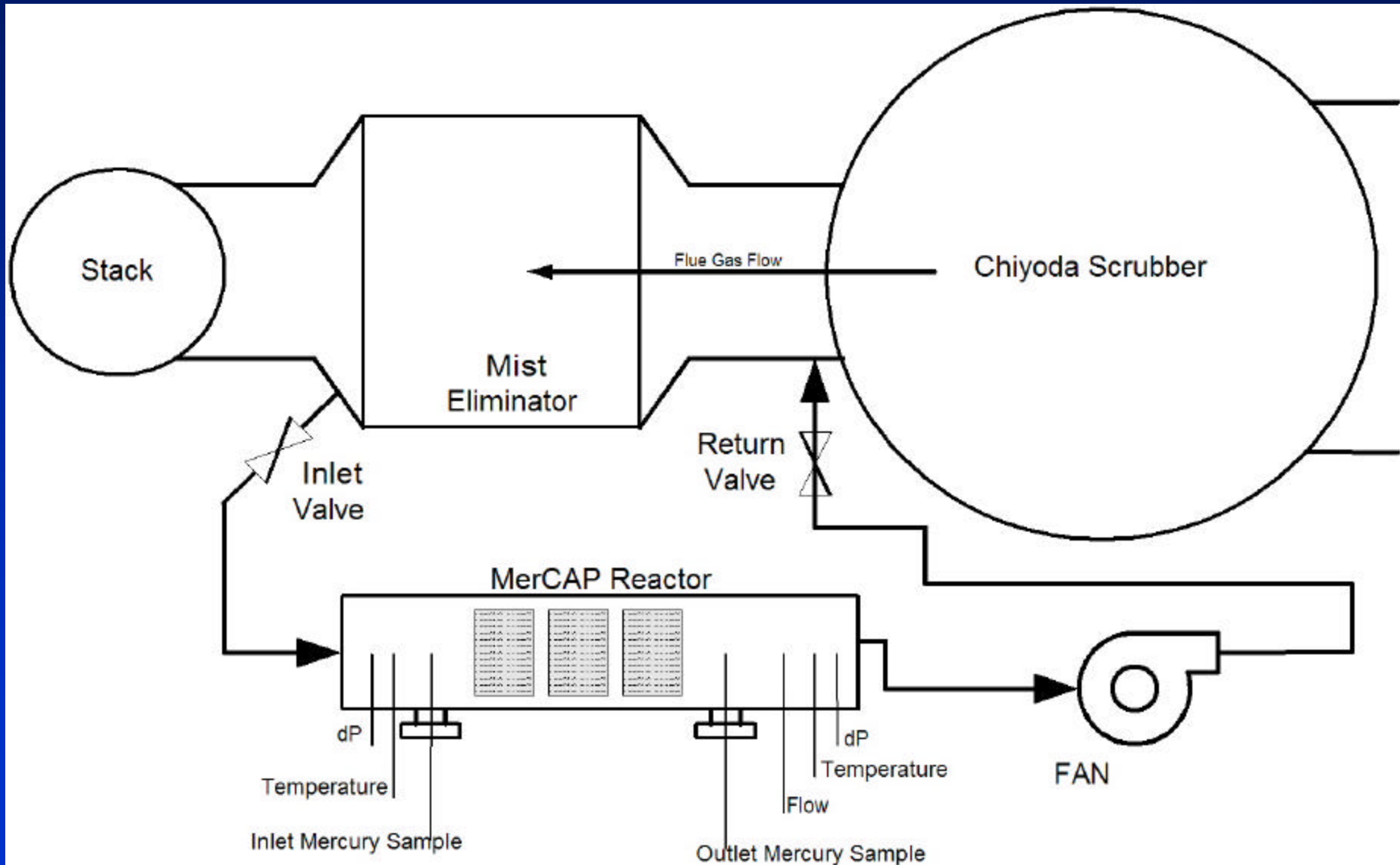
- Removal performance & variability
 - Optimal process conditions
- Regeneration
 - Thermal
 - Chemical
- Economic viability



Georgia Power Plant Yates Unit 1

Boiler	
Type	CE Tangential Fired
Nameplate (MW)	100
Coal	
Type	Eastern Bituminous
Sulfur (wt %, day)	1.0
Mercury (mg/kg, dry)	0.10
Chloride (mg/kg, dry)	300-1400
ESP	
Type	Cold-Side
SCRUBBER	
Type	Chiyoda CT-121
Scrubber Outlet Temp. (°F)	130
NO_x Controls	Low NOx Burners
SO₂ Controls	Chiyoda CT-121 wet scrubber

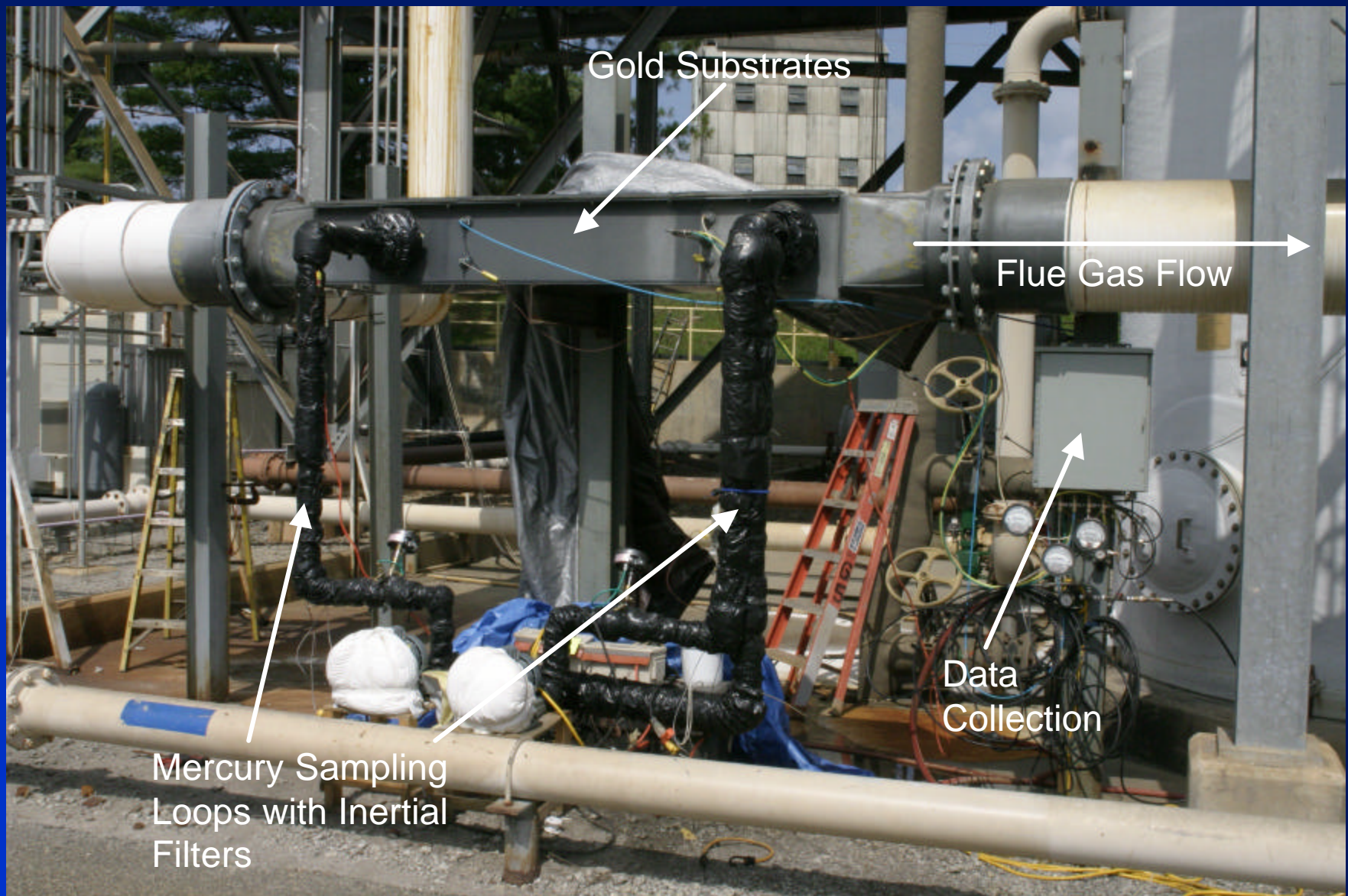
Plant Yates Unit 1 MerCAP™ Configuration



MerCAP™ Installed at Plant Yates Unit 1



MerCAP™ Reactor



Planned Tests

| Baseline Monitoring

- Determine Effects (if any) of reactor housing on mercury

| Monitoring with gold substrates

- Initial testing after installation
- 6 months continuous operation
- Mercury measurements approximately every 40 days

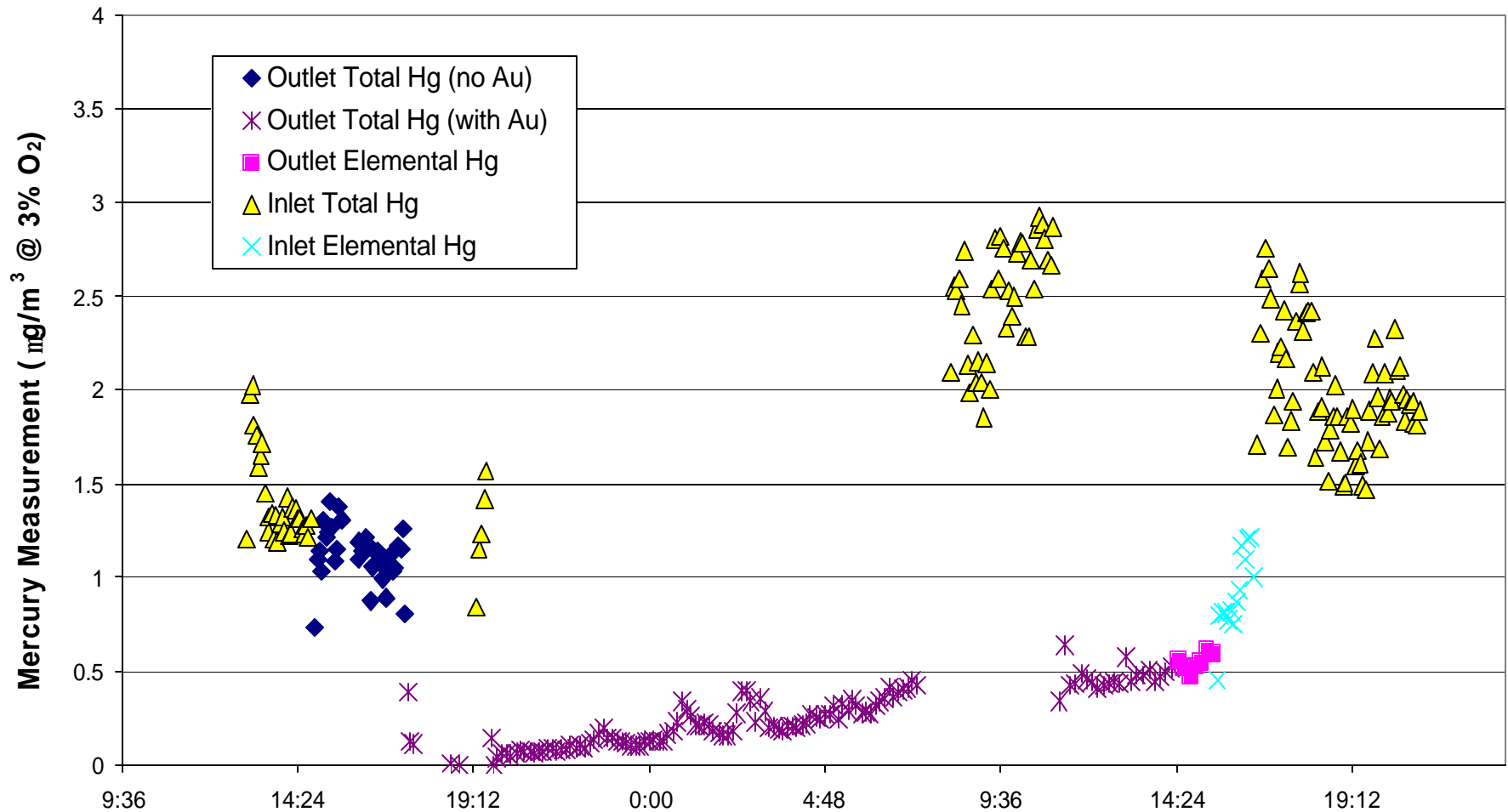
| Substrate Regeneration

- Thermal
- Chemical (acid rinse)

Project Status – Plant Yates

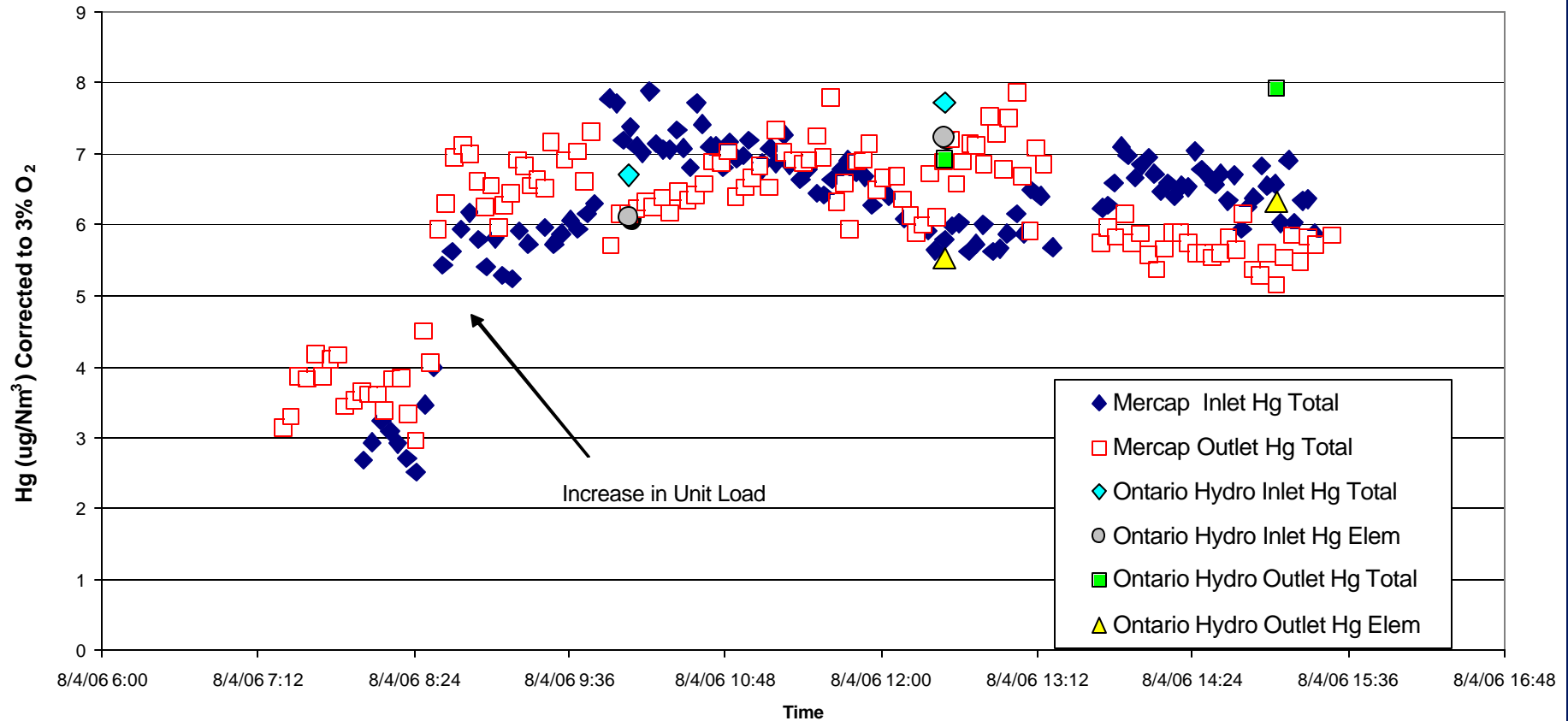
- | **Baseline Monitoring**
 - **No effect of reactor housing on mercury**
- | **Initial Mercury Measurements**
 - **Showed high mercury removal possible**
- | **Fan Failure**
 - **Acidic Flue Gas backed up through system**
 - **Corroded substrates**
- | **System re-routed to avoid high pressure drop**
 - **Substrates replaced and restarted July 2006**

Initial Results (Original Substrates)



Results (New Substrates)

Yates MerCAPTM Mercury Measurements - SCEM and Ontario Hydro
520 Hours of Service



Results (New Substrates)

Date	Flow Rate	Gold Length	Inlet Hg	Outlet Hg	% Hg Removal	Normalized Removal
	(acfm)	(inches)	(mg/Nm ³ @3%O ₂)	(mg/Nm ³ @3%O ₂)		(%/gold plate/acfm*10 ⁶)
7/13/2006	3600	36	3.61	3.08	15%	0.17
7/13/2006	2700	36	3.51	3.07	13%	0.19
7/14/2006	2700	36	4.23	3.88	8%	0.13
7/14/2006	1900	36	3.98	3.58	10%	0.22
7/14/2006	1300	36	3.98	3.61	9%	0.29
7/15/2006	1300	36	2.03	1.96	3%	0.11
7/15/2006	2700	36	4.23	4.11	3%	0.05
8/4/2006	2700	36	6.19	6.06	2%	0.03
8/18/2006	1300	12	3.53	3.30	6%	0.20

Summary – Plant Yates

- | Initial Results indicate high level of mercury removal is possible
- | Acidic conditions in flue gas corrode gold and stainless steel substrates
- | Material build-up on gold surface inhibits mercury adsorption
 - Possibly gypsum fines that pass through the mist eliminator
 - Effect of flue gas flow rate not evident when plates are fouled
 - Wash system demonstrated improvement in mercury removal in short section of gold
- | Ontario Hydro confirmed results seen with SCEMs

Future Plans for MerCAP™ at Plant Yates

- | 6 months continuous operation**
 - Parametric tests**
 - | Wash frequency**
 - | Flue gas flow rate / mass transfer**
- | Analysis of fouling material**
 - Determine best way to wash substrates**

GRE Stanton Station – FF/SDA Installation Background

- | First Phase – SDA/FF Equipped Unit**
- | Host Unit - Great River Energy's Stanton Station Unit 10**
- | First substrates installed in August of 2003 in Clean Air Plenum of Baghouse Compartment 6**
- | Initial removal high (~70-90%), removal stabilized near 35 – 40%**
- | Results on North Dakota Lignite operation showed 3 months of service at 35 – 40% removal**
- | Results on PRB operation showed varied removal depending on gas temperature and lime/slurry feed to SDA**
- | Array removed from host unit in July of this year**
- | Over 22 months continuous gas treatment service time**
- | Additional evaluations and tests funded by Great River Energy and EPRI**

GRE Stanton Station – FF/SDA Installation

Recent Work

- | Geometry parametric testing
- | Several geometry variations investigated including:
 - Varied length
 - Varied plate spacing
 - Varied orientation in flow
- | Results indicate that removal does not directly correlate to active length
- | Mass-Transfer not limiting
- | Mechanism under investigation

GRE Stanton Station – FF/SDA Installation

Recent Work

Date	Description of Geometry/Duct	Removal (%)	Duct Temp (F)	Lime Feed (GPM)	Comments
4/25/2006	Duct 1 - 10' Active Length 1-inch Plate Spacing	39.2	202.8	21	2-day Average
	Duct 2 - Empty	0			
	Duct 3 - 40 Plates Perpendicular to Flow	4.7			
	Duct 4 - 8' Active Length, Alternate Material	9.7			
5/5/2006	Duct 1 - 10' Active Length 1-inch Plate Spacing	36.2	209.2	21.5	10-day Average
	Duct 2 - 8' Active Length, Alternate Material	0			
	Duct 3 - 5 Plates Perpendicular to Flow	7.4			
	Duct 4 - 4' Active Length 1-inch Plate Spacing	26.5			
7/7/2006	Duct 1 - 10' Active Length 1-inch Acid Washed	54.6	218.6	N/A	1-Day Average
	Duct 2 - 2' Active Length 1/2-inch Plate Spacing	56.5			
	Duct 3 - 2' Active Length 1-inch Plate Spacing	25.8			
	Duct 4 - 4' Active Length 1-inch Plate Spacing	30.6			

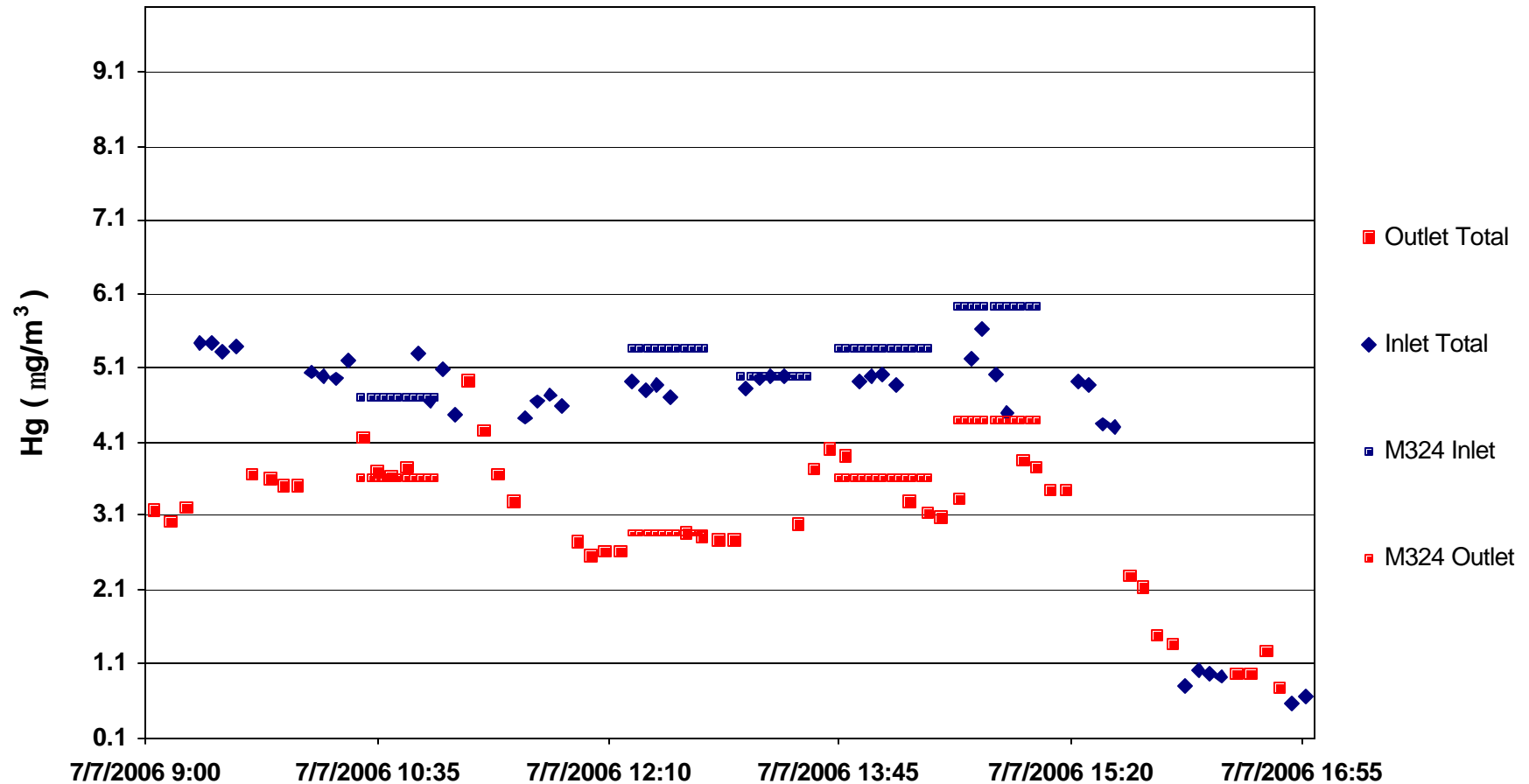
GRE Stanton Station – FF/SDA Installation

Recent Work

- 22nd Month of service time
- Method 324 Measurements conducted to verify Hg CEM results
- Removal remains variable depending on gas temperature and lime/slurry feed-rate
- 40 – 50% removal observed after nearly 2 years of continuous treatment service

Start Time	End Time	Trap ID	Inlet Hg (Trap)	Outlet Hg (Trap)	Trap Removal (%)	CEM Inlet	% Diff (inlet)	CEM Outlet	% Diff (outlet)	CEM Removal
7/7/2006 10:29	7/7/2006 10:59	2	4.72	3.59	24.01	4.98	-5.55	3.82	-6.47	23.34
7/7/2006 12:20	7/7/2006 12:50	3	5.36	2.87	46.50	4.83	9.97	2.85	0.85	41.08
7/7/2006 13:05	7/7/2006 13:30	4	5.00			4.94	1.10	3.00		
7/7/2006 13:45	7/7/2006 14:22	5	5.36	3.61	32.56	4.94	7.68	3.45	4.49	30.24
7/7/2006 14:33	7/7/2006 15:05	6	5.94	4.41	25.76	5.09	14.28	3.59	18.70	29.59

GRE Stanton Station – FF/SDA Installation Recent Work



GRE Stanton Station – FF/SDA Installation Conclusions

- MerCAP™ Array has been removed from the GRE Stanton Station Unit 10 Baghouse.**
- Nearly 2 years of continuous service and gas treatment time without regeneration**
- Six regeneration cycles demonstrated on single substrate**
- Acid pretreatment of substrate material increases mercury capture performance**
- Removal performance varies with gas temperature and limestone/slurry feed-rate to SDA**
- Removal performance does not directly correlate to active length of sorbent structure**
- Indications that mercury capture may not be mass-transfer limited**
- Final analysis of gold substrates pending**

Questions...